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Factors Influencing Adoption of Biometrics by Employees in Egyptian Five Star Hotels

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ABSTRACT

Safety and security of employees and assets are important to hotels. Biometric technology provides a solution to this issue. Our study examined factors that influence adoption of biometrics by employees of Egyptian five star hotels. Using Technology Acceptance Model (TAM) as the theoretical model to test adoption behavior, a survey was designed to explore factors including biometric devices, source of knowledge, ease of use, value added, and concerns about technology application. The Data supported a positive attitude towards biometrics application and some concerns about personal safety. A revised theoretical model was supported by the data. Limitations and recommendations are discussed.
Words: Biometrics adoption, Egyptian hotels, hotel employees

INTRODUCTION

With today's increasing terror attacks aimed at tourists, the hospitality industry around the world is greatly concerned about the safety and security of guests, employees, and property (Boss & Longmore-Etheridge, 2006; Higley, 2006). The hospitality industry, including travel and tourism, represents 3.3% of the Egyptian national GDP and 28% of investments in the country (Blanke & Chiesa, 2007). Biometrics, a technology to identify individuals or authenticate identity using unique physiological or behavioral automated pattern recognition, such as hand geometry, iris scan, retinal scan, fingerprint, speaker/voice recognition, and facial recognition, is a promising asset for hotels (Jackson, 2009).

Employee safety is a top priority for hotel management, especially with regard to work-related accidents, violence, and external factors. Keeping the workplace safe by controlling access to the hotel from outside, controlling access to specific areas inside the hotel, and controlling who has access to these areas (e.g., maintenance area, storage area, power area, and air condition unit) is difficult. Additionally, increased security can be an insurance policy protecting the reputation and long-term viability of the business. Finally, cost-effective systems promoting efficiency within the operations of the hotel are important competitive tools with bottom-line results. This study was designed to understand factors and issues that could influence the adoption of biometrics by hotels in Egypt to improve safety and security as well as the expected efficiency in hotel processes.

RESEARCH OBJECTIVES AND QUESTIONS

The goal of the study was to find out if Egyptian five-star hotel employees are aware of biometric technology, and if so, what is the source of their knowledge, and which technology they think would be acceptable. Moreover, it was important to evaluate their perception of the added value(s) to the workplace, expectation of the performance of the technology with regards to work quality and customer service, as well as their concerns about application of such technology.

Willingness to adopt any new technology depends on factors such as awareness of how this new technology works, the ease of use, the benefit to employees and management, and the financial impact considering the cost of acquiring the technology, implementation, training employees, continuous upgrades, and development. According to the known factors that affect acceptance behavior, it is plausible to hypothesize the following depiction that could represent the model for biometric adoptions in hotels. (See Figure 1).

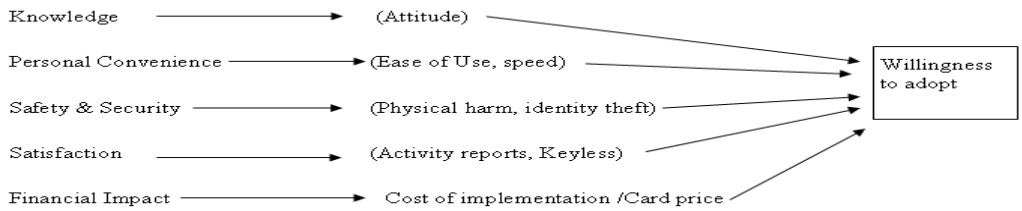

Figure 1. Technology Acceptance Model (TAM) of biometrics in hotels

A list of possible factors that could affect willingness to adopt and apply biometrics is shown in Table 1. The factors are numbered from one to six in the first row; under each factor are some variables or items which are marked alphabetically.

Table 1
Variables Possibly Affecting Willingness to Adopt Biometrics

Fingerprint	Television	Employees personal convience	Accuracy	Used for access control	Physical harm
Fical Scan	Radio	Work flow	Ease of Use	Use for attendence	Priavcy
Retinal Scan	News Paper	Safety of the work place	Speed	Identify/verfication for main enterance and restricted area	Identity theft
IRIS Scan	Used Previously	productivity Increase/decrease	Ease of upgrading and adaptability	Computer acess	Priavcy
Hand Geometry Scan	Word of Mouth	Financial impact	Maintenance need		Darta security
			Ease of obtaining report		Access to data

HYPOTHESES

Accordingly the following hypotheses were proposed:

H1a: Quality of information generated from biometrics devices positively influences perception of employees of value-added benefit to the work place.
H1b: Quality of information generated from biometrics devices positively influences ease of use.
H1c: Quality of information generated from biometrics devices influences device accepted.
H2a: Biometrics knowledge positively influences perception of employees of value-added to the work place.
H2b: Biometrics knowledge positively influences ease of use.
H2c. Biometrics knowledge influences type of device accepted.
H3a: Technological intent positively influences employees perception of value added to the work place.
H3b: Technological intent positively influences ease of use.
H3c: Technological intent influences type of device accepted.
H4a: Concerns about biometrics negatively influences employees' perception of value added to work place.
H4b: Concerns about biometrics negatively influences ease of use.
H4c: Concerns about biometrics influences type of device accepted.
H5a: Location of the biometrics device positively influences perception of value added to the work place.
H5b: Location of the biometrics device positively influences ease of use.
H5c: Location of the biometrics device influences type of device accepted.
H6: Employee perception of value added positively influences type of device accepted
H7: Employee perception of ease of use positively influences type of device accepted.

METHODOLOGY

Population and instrument:

An IRB approval was obtained from the Iowa State University Human Subjects committee before conducting the survey. The study population consisted of employees of 75 Egyptian five-star hotels distributed in South Sinai (Sharm el Sheikh), Cairo, and near the Red Sea (See Table 1) representing 48% of all the five-star hotels in Egypt.

Table 2
Hotels Contacted in Egypt

Area	Hotels contacted	Hotels accepted	Surveys distributed	Surveys collected	Response rate	Useful/ used	Final Response rate
Cairo	25	8	600	300	50%	244	40.66 %
Sharm	30	12	1000	350	35%	276	27.6 %
Hurghada	20	11	800	310	38.7%	199	24.8 %
Total	75	31	2400	960	40%	719	31.02

A five-point Likert scale (1=strongly disagree, 5=strongly agree) was used to examine willingness to adopt new technology. The survey used was based on the work of Murphy and Rottet (2009) and Kim, J., Brewer, P., & Bernhard, B. (2008) utilizing a five-point Likert scale (1=strongly disagree, 5=strongly agree) to rate the items. The items in the survey were planned to test the conceptual model proposed in Figure 1. The self-administered survey was divided into two segments. The first set of questions focused on demographic determinants (gender, marital status, age, years of education and experience, salary, work shift, and assigned department). The second set of questions were intended to understand issues related to awareness of biometrics technology such as which technology would be preferred, where to place the devices, how would the technology function in the job place, ease of use, value-added to employees and customer, and how those factors would affect willingness to use the technology.

Data Analysis

The completed surveys were analyzed using Statistical Package for the Social Sciences (SPSS 18). Descriptive analyses including frequencies and percentages of the demographic variables, the overall responses, mean and standard deviation were calculated (N=719). To test the reliabilities of the measures, the internal consistency of each of the measures was assessed via Cronbach's alpha at 0.7. One way ANOVA descriptive analysis testing was applied to examine how age, education, salary, experience, department, and shift differences related to the study variable. Significant finding had a $p<0.05$. A summary of the results (See Table 3).

Structure Equation Modeling (SEM) was used by applying path analysis. The fit of the whole model was assessed using the statistical indices Chi-square, Chi-square/degrees of freedom, Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square (SRMR). The magnitude of the individual parameters (i.e., path coefficients and correlations) was assessed at the .05 level. The direction of the individual parameters was evaluated vis-à-vis prior research findings. A predicted model was developed.

Results

Demographic data analysis showed that eighty eight percent of the respondents were males between the ages of 18 and 39 years. One third of the respondents were high school graduates (30.6%), while slightly more than one third were college graduates (36.4%). More than half of the respondents were single (53.4%). The majority of the respondents earned between 500 and 3,000 Egyptian pounds (72%). Sixty six percent of the respondents worked at resort hotels in the morning shift.

The participants reported that source television and word of mouth were the major sources of knowledge about biometrics. One hundred and fifty respondents had never heard about biometrics, but were able to answer the questions because the survey had pictures. Finger print devices were preferred by employees who wanted to place them at the employee entrance. The participants felt that biometrics technology was easy to use, flexible and adaptable to change, the information obtained from the device was clear and accurate, and the use of this technology would help security. Physical harm and concerns about who has access to the information were at the top of the list of concerns when it came to biometrics.

ANOVA Analysis:

Several reliable variables were identified, and ANOVA testing was done to examine the relation between factors such as age, education, economical status, work experience, type of work, and work schedule and the study variables such as concern about technology, quality of the information generated by biometrics, knowledge about biometrics, ease of use, value-added, technological intent, and location of placement of biometrics devices (see Table 3).

Table 3
Descriptive Statistics of the Study Variables

Variable	Range	Mean	*SD*	Skew
Ease of use	1 to 5	3.90	.78	.12
Added value	1 to 5	3.68	.88	-.39
Location of device	1 to 5	3.24	1.02	-.32
Concern about use	1 to 5	3.17	0.94	-.16
Type accepted	1 to 5	3.07	.78	.12
Total knowledge	0 to 6	2.45	1.42	.09
Technological intent	1 to 3	1.89	.67	.14

(N=719), SE for Skew Statistic = .09

ANOVA descriptive analysis testing was applied to examine how age, education, salary, experience, department, and shift differences relate to technological intent, concern about use, location of device, knowledge, added value, ease of use, and type accepted (See table 4).

Table 4
ANOVA Descriptive Analysis Summary

	concern	Quality of information	Knowledge	Ease of use	Value added	Technological intent	Location of device
Age	NS	NS	S	S	NS	NS	NS
Education	NS	S	NS	S	S	S	S
Economical status	S	S	S	S	S	S	NS
Work Experience	NS	NS	NS	NS	NS	NS	NS
Work Type	NS	NS	S	S	S	S	NS
Work Schedule	NS	NS	S	NS	NS	NS	NS

S=Significant, NS=Not significant

Path Analysis:

The above tested variables were used in the path analysis, and the results did not fit the proposed model as seen in Figure 2. A revised model was developed where the data fit better (see Figure 3). The revised model reduced the significant correlations in the proposed direction of quality of information to value-added, the path from technological intent to value-added, and the path from location to type accepted. The path of knowledge and to type accepted and the path of value-added to type accepted was almost significant

To confirm factor analysis, the (SEM) was used by magnitude and direction of its individual parameters must be assessed (Kline, 2005). Thus, the fit of the whole model was assessed using the following statistics and indices:

1. Chi-square.

2. Chi-square/degrees of freedom—the lower the ratio, the better the fit; not much agreement on cut-off points at this time (some say two, while others say three).
3. Comparative fit index (CFI)—indices above .95 indicate good fit (Hu & Bentler, 1999); indices above .90 indicate reasonable fit (Hu & Bentler, 1998).
4. Root mean square error of approximation (RMSEA)—indices below .06 indicate good fit; indices below .08 indicate reasonable fit; indices below .10 indicate mediocre fit (Browne & Cudeck, 1993).
5. Standardized root mean square (SRMR)—values less than .08 indicate good model fit (Hu & Bentler, 1998).

The magnitude of the individual parameters (i.e., path coefficients and correlations) was assessed at the .05 level. The direction of the individual parameters was evaluated vis-à-vis prior research findings. The proposed path model (with the standardized coefficients) is depicted in Figure 2. The fit statistics and indices are summarized (see Table 5). This proposed model did not fit the data well. Although the SRMR was below .08, the ratio of the chi-square to the degrees of freedom was high; the CFI was below .95, and the RMSEA was above .10. Further, not all path and correlation coefficients were statistically significant.

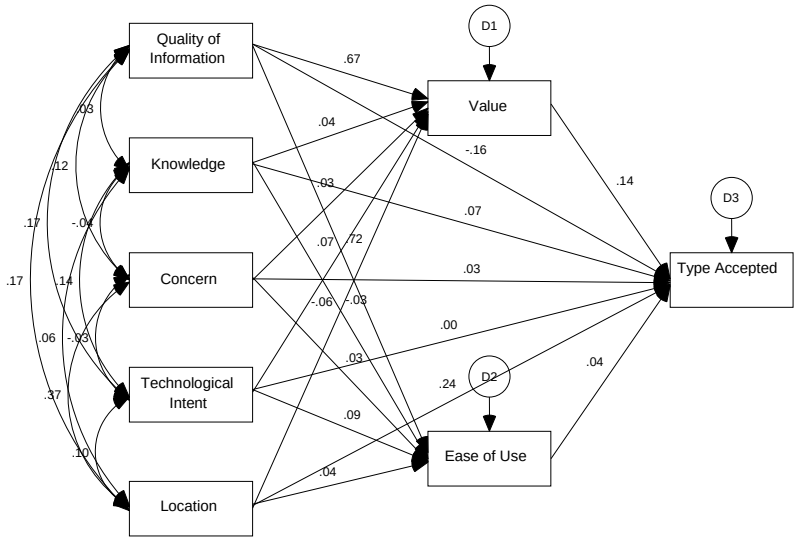

Figure 2. The proposed path model (with standardized coefficients)

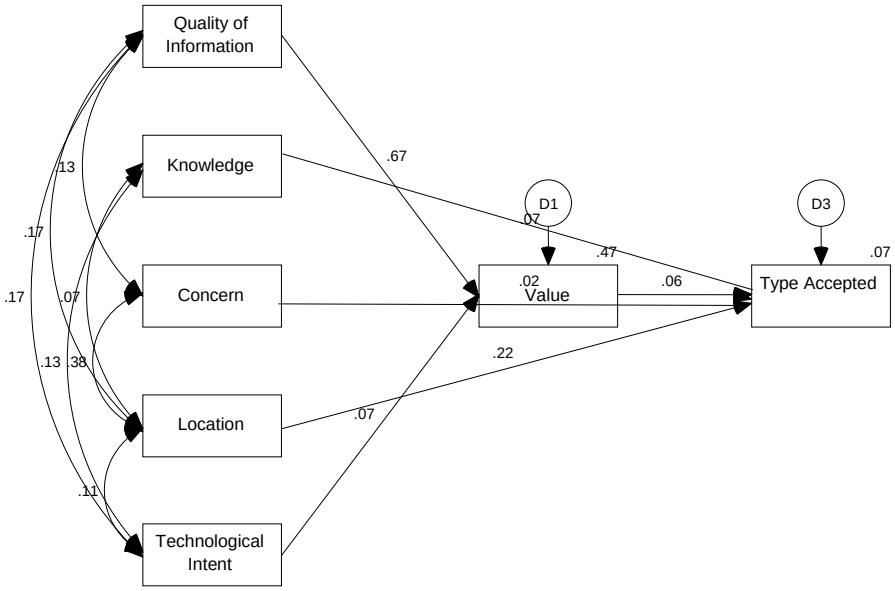

Figure 3. The revised model with the significant relation.

Table 5
Fit Statistics and Indices for the Proposed and Revised Path Models

Index	Proposed	Revised	Index	Proposed	Revised
Chi Square	141.52	15.3	Root Mean Square error (RMSE)	.44	.04
Degree of Freedom	1	8	Lower bound of 90 percent confidence interval	.38	.00
Sig.	.00	.05	Upper bound of 90 percent confidence interval	.51	.06
Chi Sq /df	141.52	1.94	Standardized root mean square residual (SRMR)	.03	.02
Comparative fit index CFI	.90	.99			

Results of the Revised Model:

Accordingly, a second path model was tested. All predictors were kept in the model, but only the paths and correlations that were statistically significant were kept in the model. This revised path model is depicted in Figure 3. The fit statistics and indices are summarized in Table 5. The direct revised path coefficients are shown in Table 6, while the indirect revised path coefficients are displayed in Table 7. This proposed model fit the data well. The ratio of the chi-square to the degrees of freedom was below three; the CFI was above .95; the RMSEA was below the acceptable criterion of .06; and the SRMR was below .08.

Three of the six path coefficients were statistically significant and in the predicted direction: the path from quality of information to value, the path from technological intent to value, and the path from location to acceptability of eye biometrics. Two of the six path coefficients were almost significant and in the predicted direction: the path from knowledge to acceptability of eye biometrics, and the path from value to acceptability of eye biometrics.

Table 6
Standardized and Unstandardized Path Coefficients for the Revised Direct Path Model

Path	B	SE	Beta	C.R.	Sig.
Quality to value	4.95	.20	.67	24.29	.000
Knowledge to type	.06	.03	.07	1.84	.066
Concern to type	.03	.05	.02	.62	.537
Location to type	.27	.05	.22	5.67	.000
Technology to value	.65	.26	.07	2.56	.010
Value to type	.01	.01	.06	1.73	.083

Table 7
Standardized and Unstandardized Coefficients for the Revised Indirect Path Model

Path	B	SE	Beta	C.R.	Sig.
Quality of information and:					
concern	.10	.03	.13	3.42	.000
location	.14	.03	.17	4.46	.000
technology	.10	.02	.17	4.62	.000
Knowledge and:					
location	.11	.05	.07	2.12	.034
technology	.13	.04	.13	3.59	.000
Location and:					
technology	.07	.02	.11	3.08	.002
concern	.37	.04	.38	9.56	.000

Discussion

This study is the first of its kind to explore the factors that affect Biometrics technology acceptance in Egyptian five star hotels. The hotels contacted represented 48% of Egyptian five star hotels in Cairo, Sharm el-Sheikh, and Hurgada, and of those 40% participated in the survey. The participants in the survey were predominantly men (87.9%), consistent with prior studies of the hospitality work force in Egypt (Kattara, 2005). The majority were between the ages of 18 and 39 (87.6 %) and were educated (high school, college, and postgraduate) (83.8%). More than 50% were single, and the majority earned between 500-3,000 LE (66. 1%).

The primary goal was to get a better understanding of Egyptian hotel employees' perceptions and tendencies to adopt biometrics in hotels. The survey participants reported that television and word of mouth were the sources of their knowledge of biometrics. Other methods such as newspapers or radio were ineffective, and nearly 10% of the participants claimed they did not know anything about biometrics. When these participants were given the survey with the pictures of several biometrics devices, they realized they were familiar with the technology or recalled prior knowledge. This information is useful when planning future training or education, as the use of television or visual media might be a better vehicle to disseminate information or educate employees.

When the questions in the survey inquired about the type of the biometrics technology or devices, the participants favored fingerprint biometrics, followed by the retina and iris scans. This could be attributable to the use of this technology by Egyptians in government facilities or the banking systems.

The survey attempted to gather employees' thoughts about the expected performance of biometrics with regards to security of the facility, ease of use, flexibility, and low cost of maintenance. The employees related that biometrics applications would be easy to use, flexible, fast, and would require low maintenance especially with the development of technology. In an effort to improve quality and customer services, employees reported that the information generated would be clear, accurate, and updated, and could be displayed in a useful and adaptable format. They indicated that this application would have a great added value to security, data collection, convenience, and improved productivity that would, in turn, increase customer satisfaction. The employees favored placement of the device at the employees' entrance, followed by a clock in/out procedure used to access rooms, secure areas, storage, and computers. They were concerned about personal harm from using this technology, especially regarding pregnant women. Access to information, identity theft, and privacy were other concerns.

Reviews of the findings with the most significant hypotheses, are as follows:

1. Findings confirmed H1a where quality of information generated from biometrics devices positively influences perception of employees of value-added to the work place.
2. Findings confirmed H3a where technological intent positively influences employees' perception of value-added to the work place.
3. Findings confirmed H5c where location of the biometrics device influences type of device accepted.

Limitations

The limitations discovered in this study included the sample used only five-star hotels in Egypt , and may not be generalized to all types of hotels in Egypt or even the Middle East. It was difficult to administer the surveys to employees directly because of logistics and rules of hotels which could have affected the response rate.

Recommendations

The outcome of this research should encourage the hotel management to plan for training programs before the implementation of biometrics. The training should focus on the benefits and value-added which seemed to be a major driver and factor mentioned by the participants as a possible motivator for adoption or use for a device. Special emphasis in the training should be directed towards the personal benefits reaped from such technology. Participation in the survey was limited due to a number of obstacles. This research suggests that a close collaboration between universities in Egypt and the U.S. could improve access to data and employees to gather information and allow better understanding. Methods used in the U.S. to encourage participation, such as compensations or gifts, were not used as they are not acceptable or are considered a shameful act in Egypt. Studies on behavior and cultural differences should continue and use both quantitative and qualitative research to better understand the population.

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